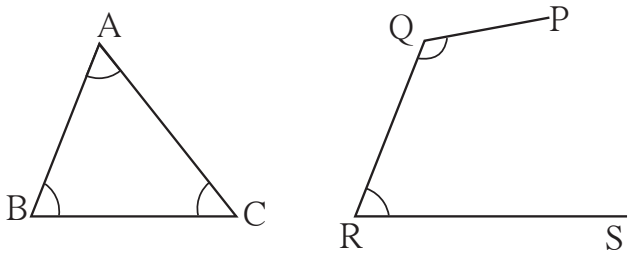
# 15 Triangles and their Properties

## Let's discuss.




In the figure alongside, some points and some line segments joining them have been drawn.
Which of these figures is a triangle?
Which figure is not a triangle? Why not?

$\Delta ABC$ has three sides. Line segment AB is one side. Write the names of the other two sides. $\Delta ABC$ has three angles. $\angle ABC$ is one of them. Write the names of the other angles.

Points A, B and C are called the vertices of the triangle.

## Let's learn.

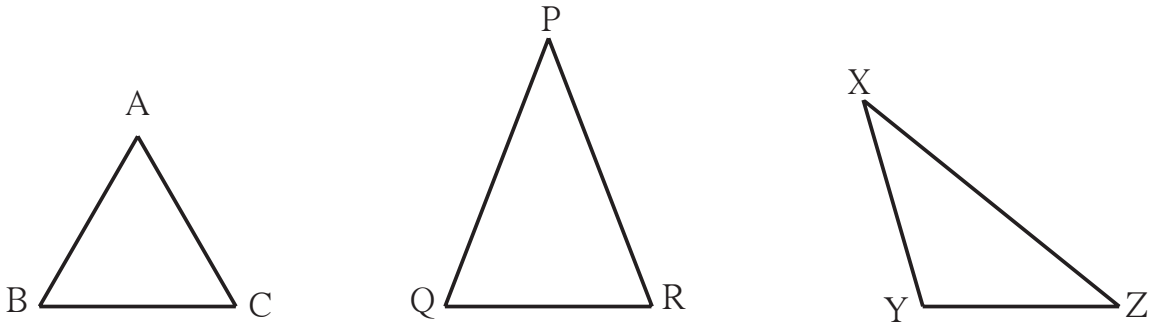
**A triangle is a closed figure made by joining three non-collinear points by line segments.**

**The vertices, sides and angles of a triangle are called the parts of the triangle.**

### Types of Triangles – Based on Sides

Measure the sides of the following triangles in centimetres, using a divider and ruler. Enter the lengths in the table below. What do you observe?

'Length of line segment AB' is written as $l(AB)$.




| In $\Delta ABC$ | In $\Delta PQR$ | In $\Delta XYZ$ |
|---|---|---|
| $l(AB)$ = ..... cm | $l(QR)$ = ..... cm | $l(XY)$ = .... cm |
| $l(BC)$ = ..... cm | $l(PQ)$ = ..... cm | $l(YZ)$ = .... cm |
| $l(AC)$ = ..... cm | $l(PR)$ = ..... cm | $l(XZ)$ = .... cm |

In the table above, the lengths of all sides of ΔABC are equal. Therefore, this triangle is an equilateral triangle. 'Lateral' refers to the sides of a figure.

**A triangle with all three sides equal is called an equilateral triangle.**

In ΔPQR, the length of the two sides PQ and PR are equal. ΔPQR is called an isosceles triangle.

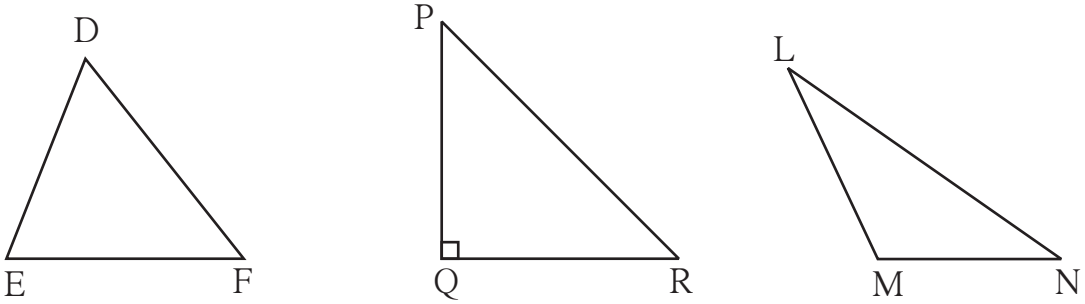
**A triangle with two equal sides is called an isosceles triangle.**

The lengths of the sides of ΔXYZ are all different. Such a triangle is called a scalene triangle.

**A triangle with no two sides equal is called a scalene triangle.**

## Types of Triangles – Based on Angles

Measure all the angles of the triangles given below. Enter them in the following table.




| In ΔDEF | In ΔPQR | In ΔLMN |
|---|---|---|
| Measure of ∠D = $m$∠D =.....° | Measure of ∠P = $m$∠P =.....° | Measure of ∠L = .....° |
| Measure of ∠E = $m$∠E = .....° | Measure of ∠Q = ..... = .....° | Measure of ∠M = .....° |
| Measure of ∠F = ..... = .....° | Measure of ∠R = ..... = .....° | Measure of ∠N = .....° |
| Observations: All three angles are acute angles. | One angle is a right angle and two are acute angles. | One angle is an obtuse angle and two are acute. |

In the figures above, ΔDEF is an acute angled triangle.

**A triangle with all three acute angles is called an acute angled triangle.**

ΔPQR is a right angled triangle.

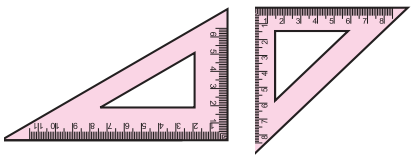
**A triangle with one right angle is a right angled triangle.**

ΔLMN is an obtuse angled triangle.

**A triangle with one obtuse angle is called an obtuse angled triangle.**

**Try this.**

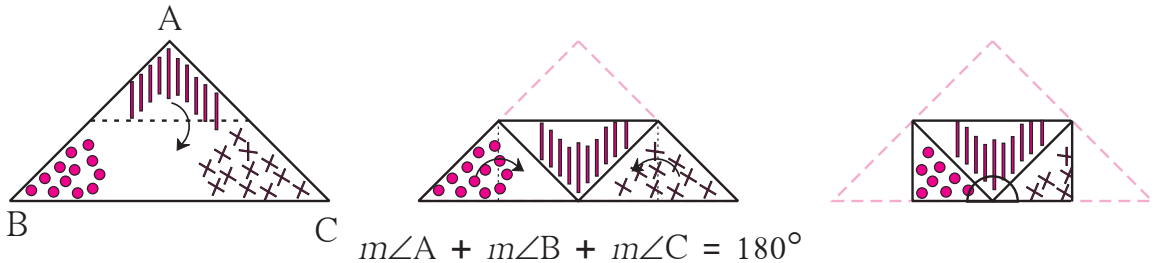
Observe the set squares in your compass box.
What kind of triangles are they?



Try this.

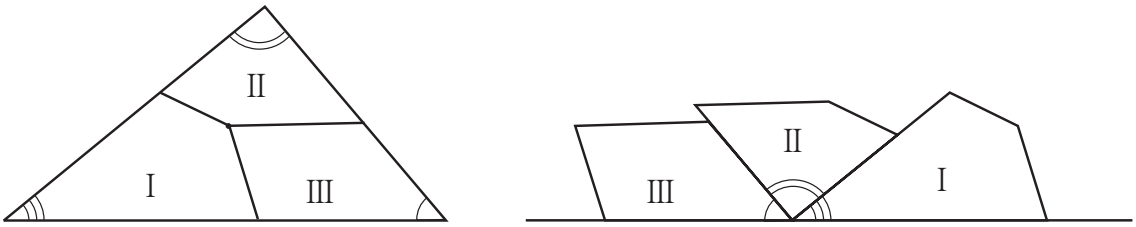
## Properties of a Triangle

**Activity :** Take a triangular piece of paper. Choose three different colours or signs to mark the three corners of the triangle on both sides of the paper. Fold the paper at the midpoints of two sides as shown in the pictures.




$m\angle A + m\angle B + m\angle C = 180°$

**Activity :** Take a triangular piece of paper and make three different types of marks near the three angles. Take a point approximately at the centre of the triangle. From this point, draw three lines that meet the three sides. Cut the paper along those lines. Place the three angles side by side as shown.




See how the three angles of a triangle together form a straight angle, or, an angle that measures 180°.

Now I know –

**The sum of the measures of the three angles of a triangle is 180°.**

**Activity :** Draw any triangle on a paper. Name its vertices A, B, C. Measure the lengths of its three sides using a divider and scale and enter them in the table.

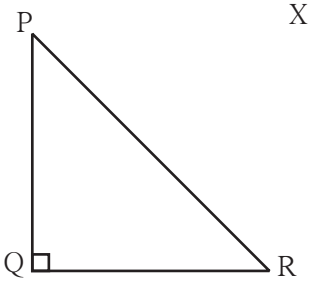
| Length of side | Sum of the length of two sides | Length of the third side |
|---|---|---|
| $l$(AB) = .... cm | $l$(AB) + $l$(BC) = .... cm | $l$(AC) = ..... cm |
| $l$(BC) = .... cm | $l$(BC) + $l$(AC) = .... cm | $l$(AB) = ..... cm |
| $l$(AC) = .... cm | $l$(AC) + $l$(AB) = .... cm | $l$(BC) = ..... cm |

Now I know –

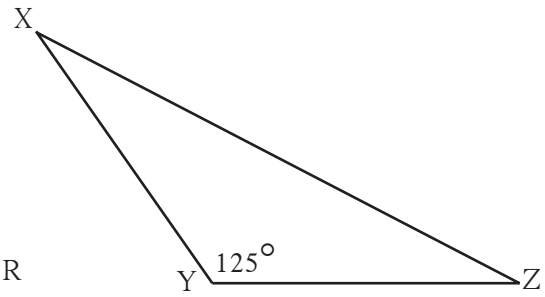
**The sum of the lengths of any two sides of a triangle is always greater than the length of the third side.**

## Practice Set 36

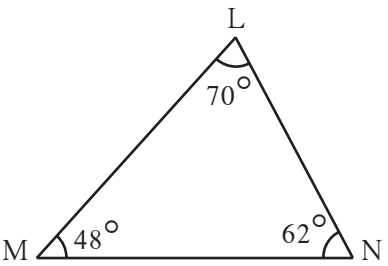
1. Observe the figures below and write the type of the triangle based on its angles.




$\Delta PQR$ is …… triangle.

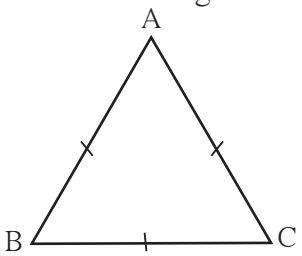



$\Delta XYZ$ is …… triangle.

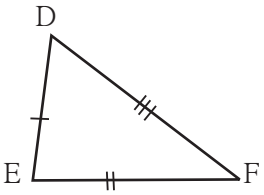



$\Delta LMN$ is …… triangle.

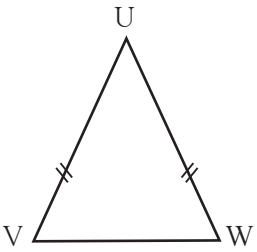
2. Observe the figures below and write the type of the triangle based on its sides.



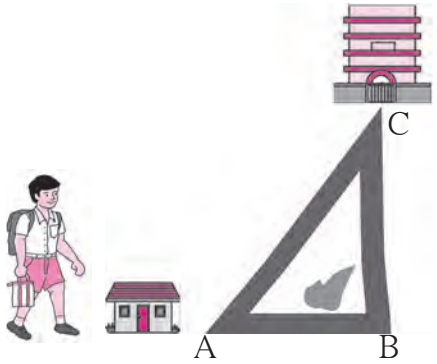

$\Delta ABC$ is ….. triangle.




$\Delta DEF$ is …… triangle.




$\Delta UVW$ is …… triangle.




3. As shown in the figure, Avinash is standing near his house. He can choose from two roads to go to school. Which way is shorter? Explain why.

4. The lengths of the sides of some triangles are given. Say what types of triangles they are.

(1) 3 cm, 4 cm, 5 cm
(2) 3.4 cm, 3.4 cm, 5 cm
(3) 4.3 cm, 4.3 cm, 4.3 cm
(4) 3.7 cm, 3.4 cm, 4 cm

5. The lengths of three segments are given for constructing a triangle. Say whether a triangle with these sides can be drawn. Give the reason for your answer.

(1) 17 cm, 7 cm, 8 cm
(2) 7 cm, 24 cm, 25 cm
(3) 9 cm, 6 cm, 16 cm
(4) 8.4 cm, 16.4 cm, 4.9 cm
(5) 15 cm, 20 cm, 25 cm
(6) 12 cm, 12 cm, 16 cm